April 7, 1970 J. H. BRINKER 3,504,465

PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 1

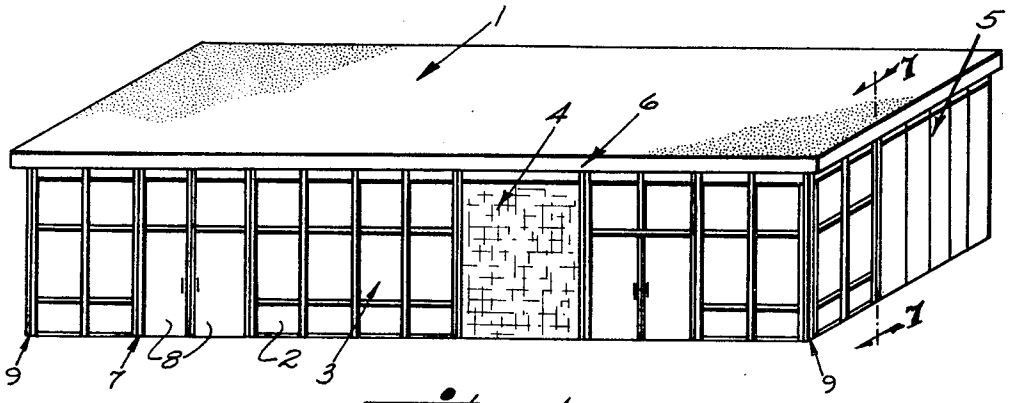


Fig. 1

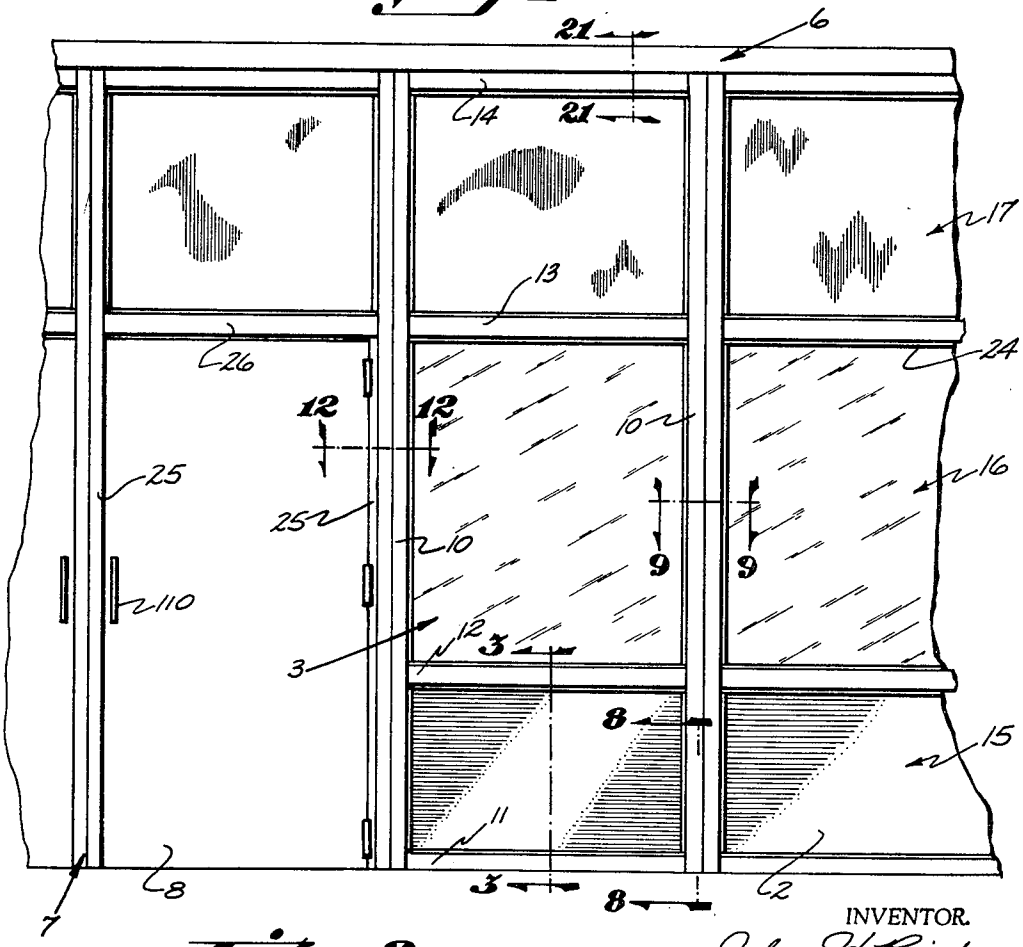


Fig. 2

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PREFABRICATED SECTIONAL BUILDING WALL

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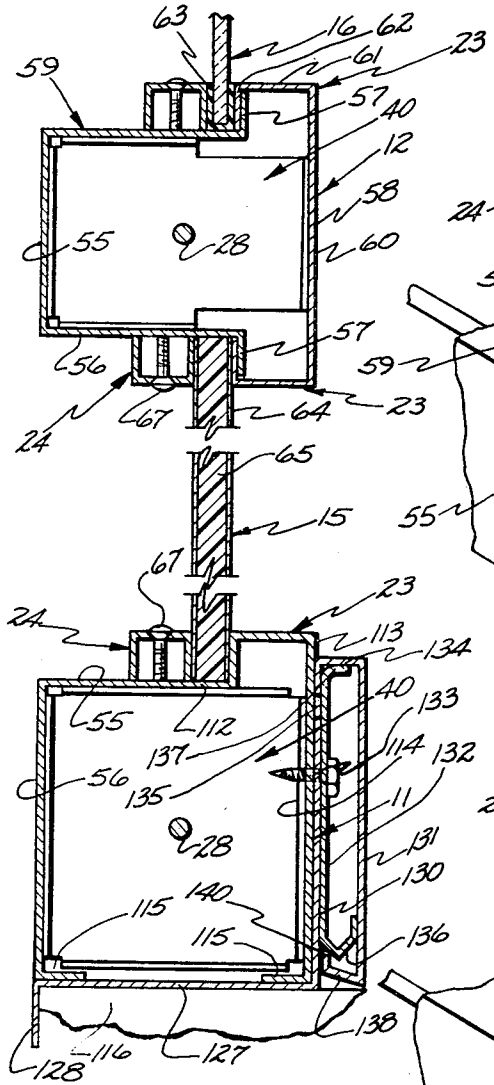


Fig. 3

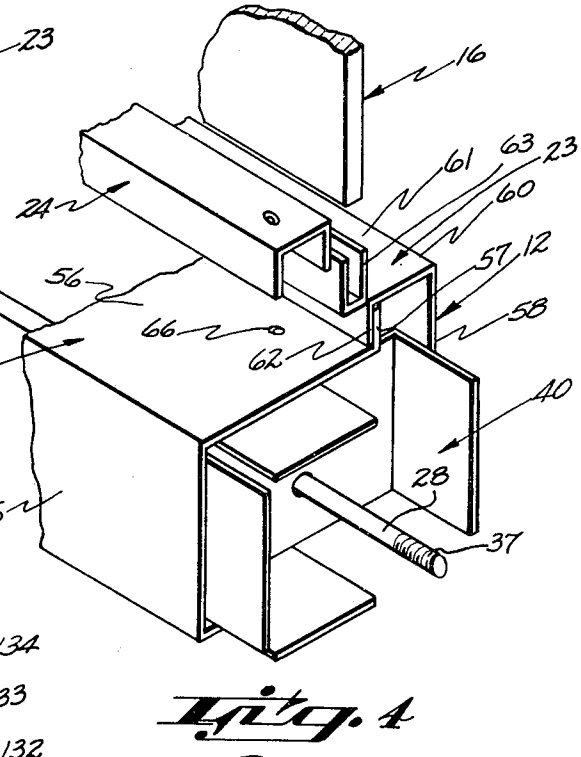


Fig. 4

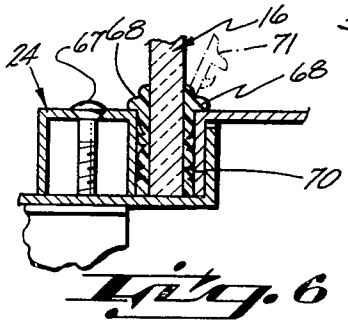


Fig. 6

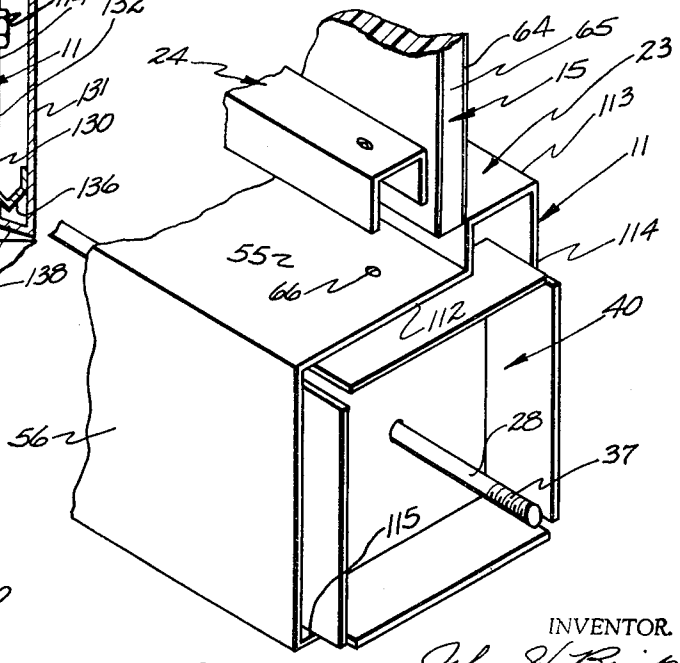


Fig. 5

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April 7, 1970 J. H. BRINKER 3,504,465

PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 3

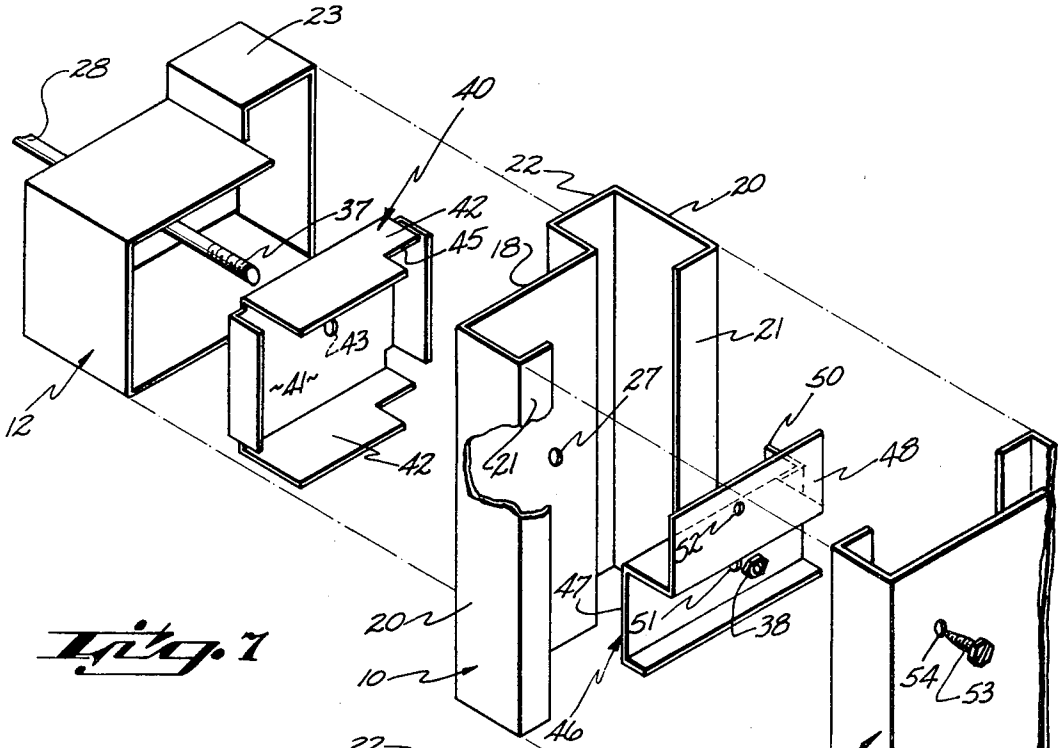


Fig. 7

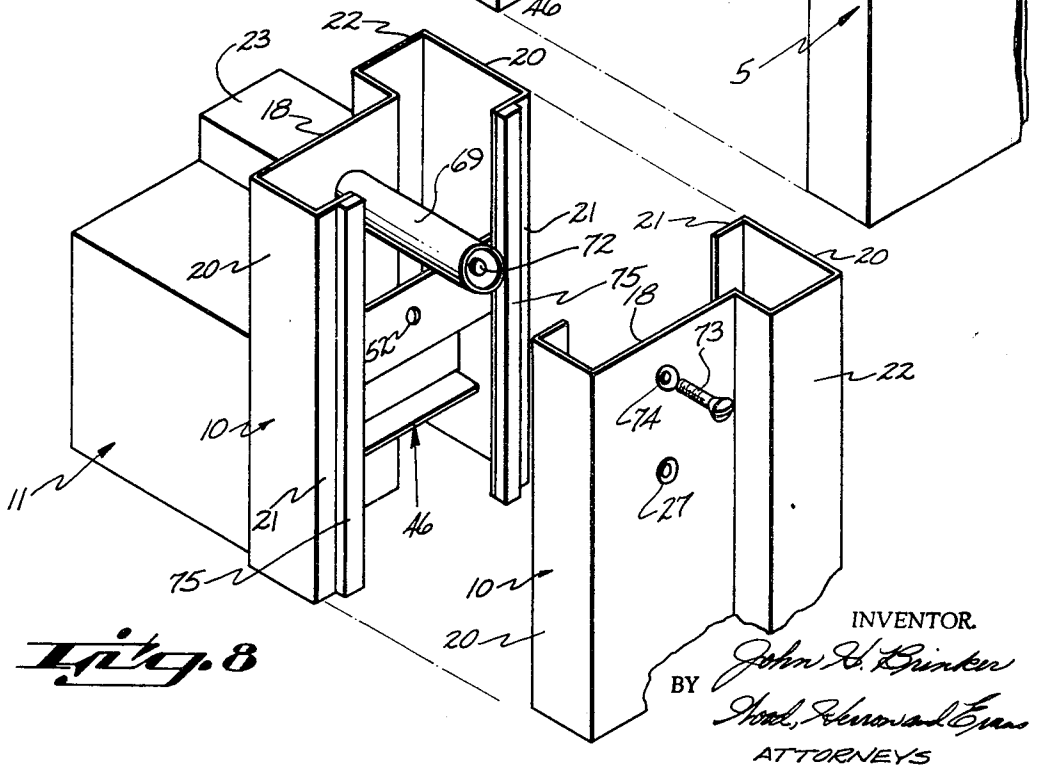


Fig. 8

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PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 4

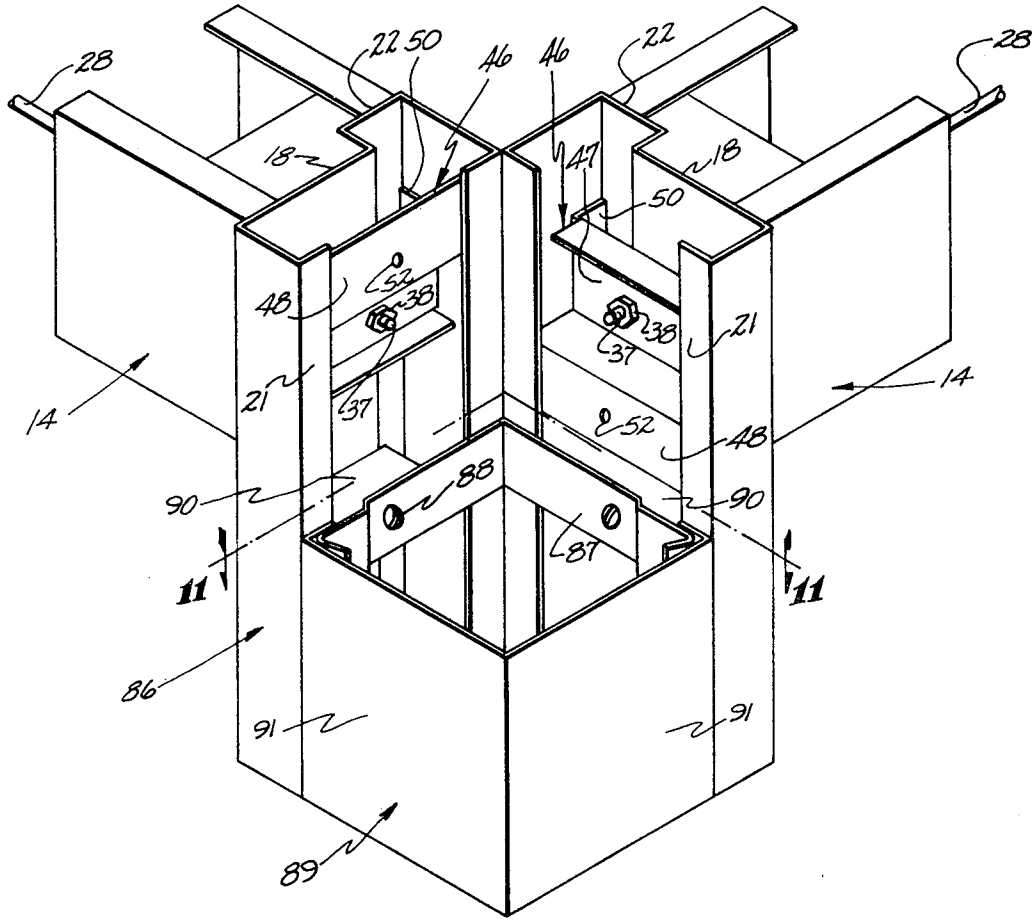


Fig. 10

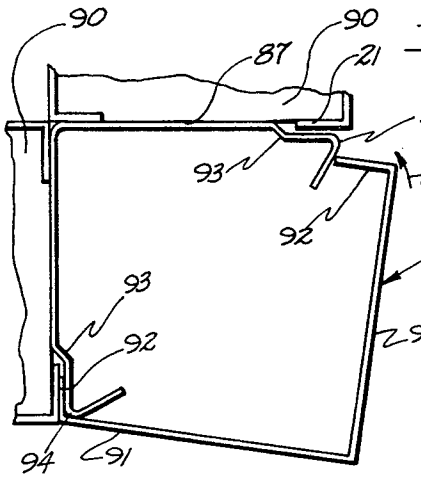


Fig. 11

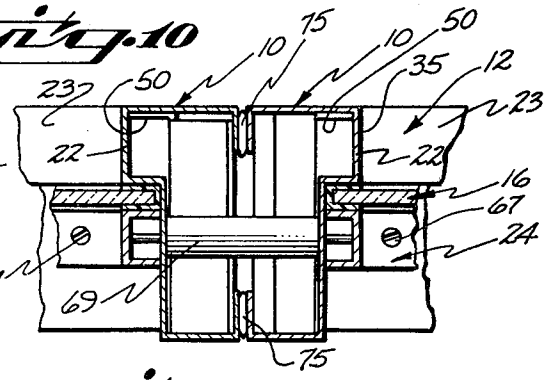


Fig. 9

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PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 5

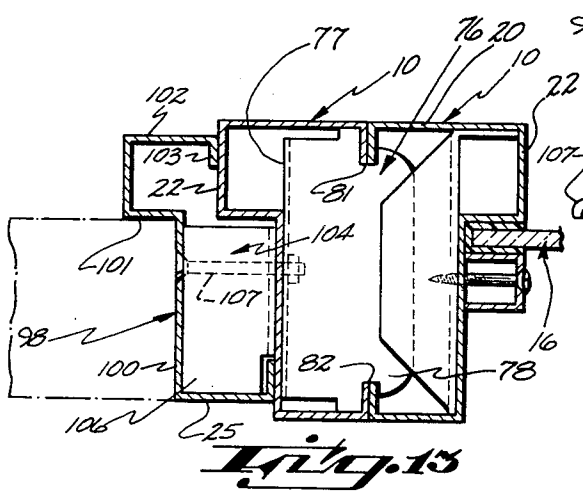


Fig. 13

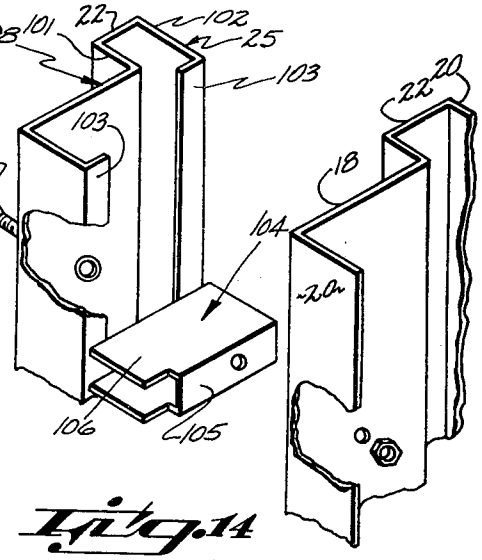


Fig. 14

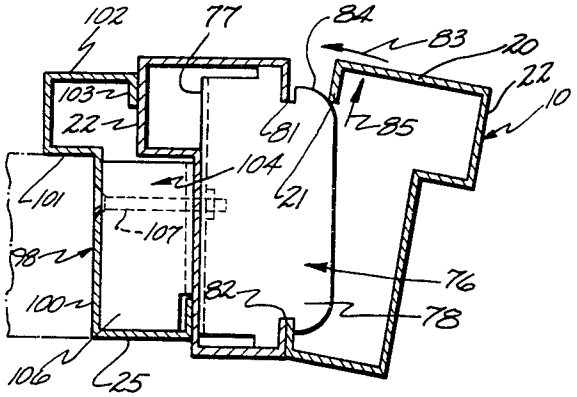


Fig. 15

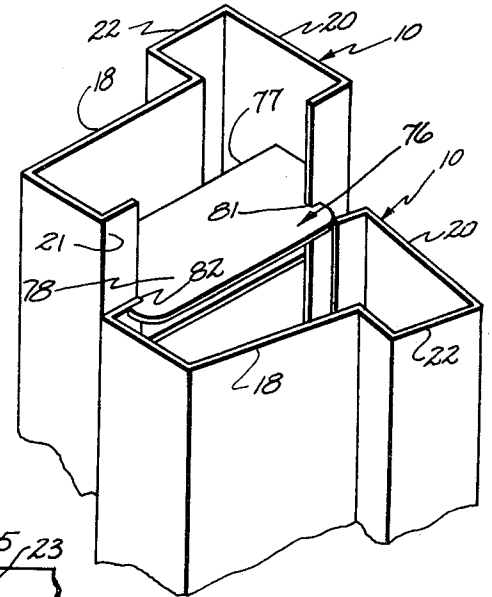


Fig. 16

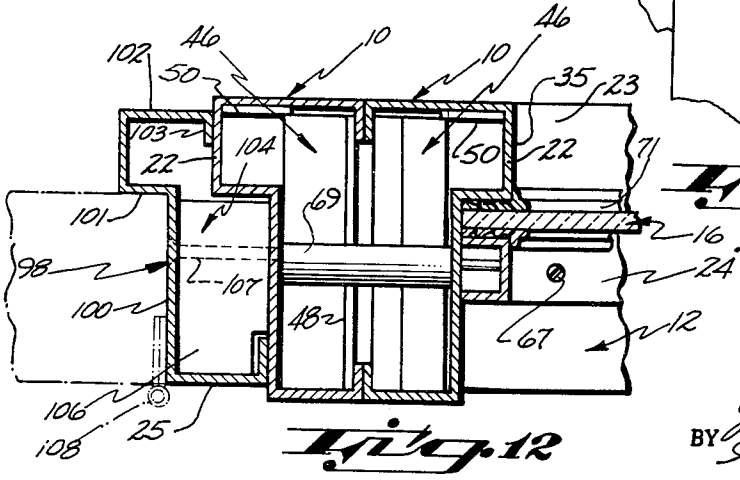


Fig. 12

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April 7, 1970 J. H. BRINKER 3,504,465

PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 6

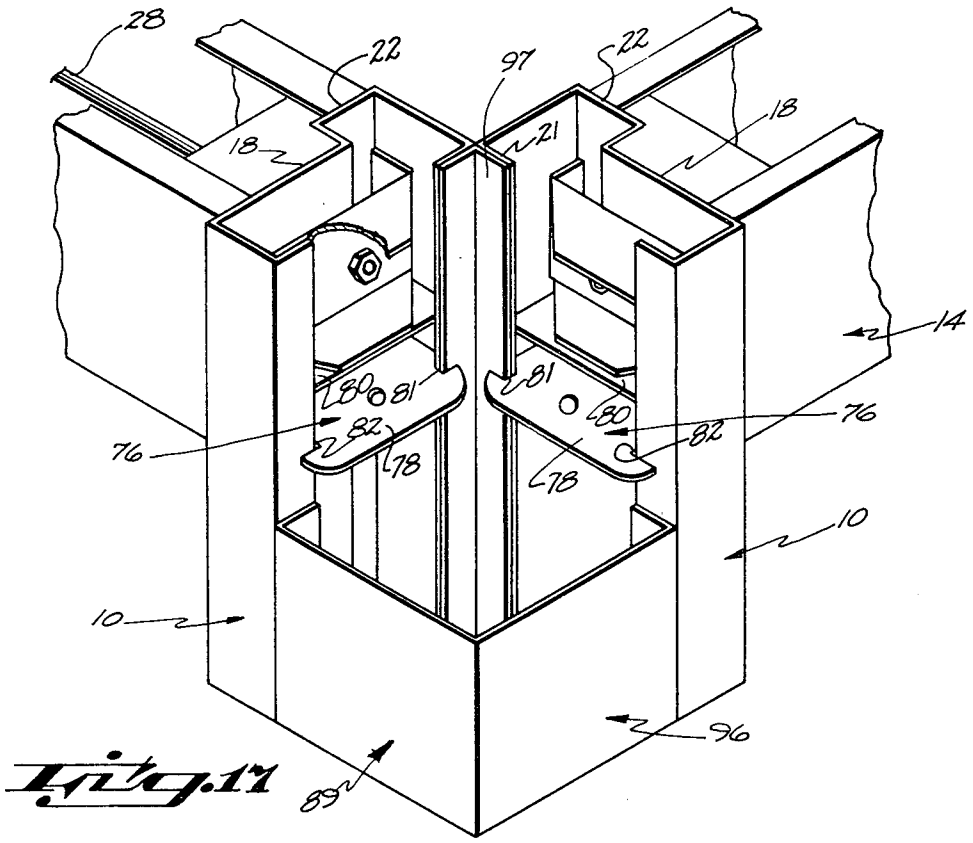


Fig. 17

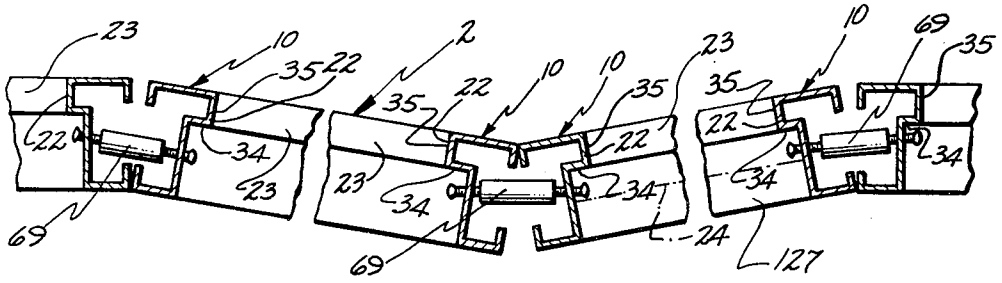


Fig. 20

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PREFABRICATED SECTIONAL BUILDING WALL

Filed May 27, 1968 7 Sheets-Sheet 7

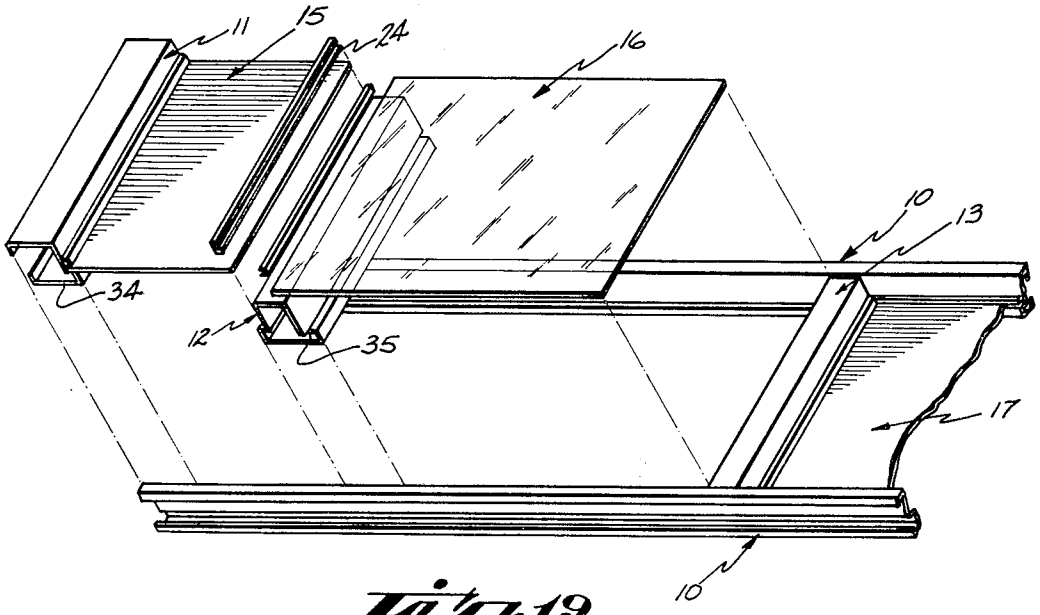


Fig. 19

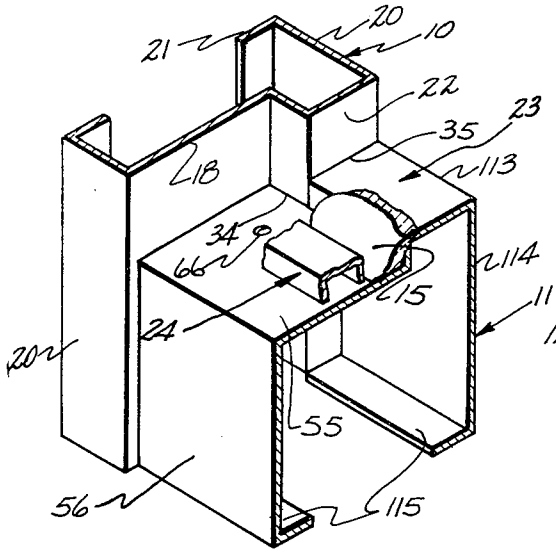


Fig. 18

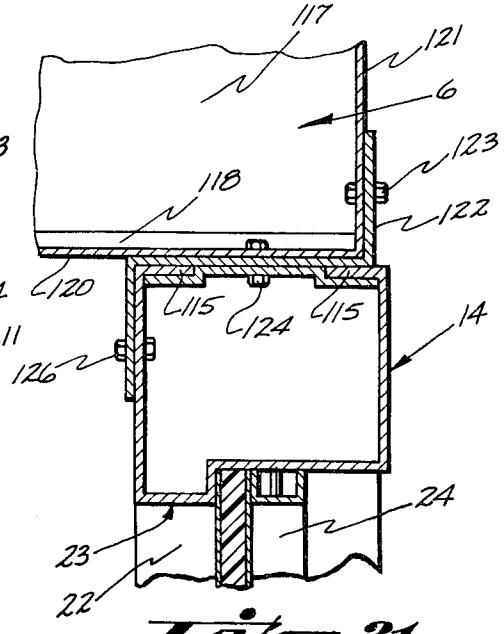


Fig. 21

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United States Patent Office 3,504,465 Patented Apr. 7, 1970

3,504,465

PREFABRICATED SECTIONAL BUILDING WALL

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Filed May 27, 1968, Ser. No. 732,291
Int. Cl. E04c 2/74
U.S. Cl. 52—282 8 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure is directed to a building wall constructed of prefabricated sections, each comprising vertical load-bearing columns or mullions formed of sheet metal spaced apart from one another, with horizontal beams or transoms, also formed of sheet metal, spanning the spaced vertical columns and clamped under compression between them. The wall sections include closure panels of composite sheet metal construction, together with glass window panes, the closure panels and window panes being arranged in selected relationship and mounted within the several openings delineated by the vertical columns and horizontal beams. The building wall is constructed by assembling the prefabricated wall sections in side-by-side relationship, with the edges of the sections rigidly clamped together. A wall section of this construction is known in the industry as a "window wall."

Each wall section is self-contained, the arrangement being such that the individual wall sections are modular in width and include doorframes, also modular in width. The assembled wall sections are capable of supporting the roof structure of the building and are also capable of resisting lateral forces, such as wind pressure, acting against the wall or walls. The vertical load-bearing columns and the horizontal cross beams are hollow in cross section and are clamped rigidly in assembled relationship by means of tie rods passing through the hollow beams or transoms. Nuts are applied to the opposite end portions of the tie rods in bearing relationship with the webs of the sheet metal beams and tightened to provide a rigid load-bearing assembly. The tie rods thus clamp the cross beams under compression between the load-bearing columns, with the tie rods under tension, to provide a rigid structure. The glass and composite sheet metal panels are placed within the openings delineated by the framing members and secured in place by suitable retaining strips.

BACKGROUND OF THE INVENTION

The individual, prefabricated, modular wall sections are erected upon a foundation or footing to support the assembled wall sections in load-bearing relationship to the roof structure of the building. In the present example, the prefabricated modular wall sections are furnished in widths of four feet, the length of the sections being made selective in accordance with the height of the building, being furnished, for example, in lengths of eight, ten or twelve feet. The roof structure is erected directly upon the top of the assembled wall sections after they have been erected upon the footing or foundation, with the doorframes located within the erected wall at desired locations.

One of the primary objectives of the invention has ben to provide an inexpensive, prefabricated wall section which may be assembled at the manufacturing plant or

in the field, with closure panels and glass panes arranged in a selected pattern or relationship, to be erected at the building site in a rapid convenient manner with the use of simple tools.

According to this aspect of the invention, the hollow load-bearing columns or mullions, which are formed of sheet metal, and the hollow horizontal connecting beams or transoms, also formed of sheet metal are pre-cut to the required lengths, preferably at the plant. These members are assembled in a simple manner by placing the tie rods through the hollow beams and by clamping the columns rigidly against the opposite ends of the beams, with the beams under compression between the columns and the tie rods under tension to provide a rigid, self-contained frame structure.

In order to mount the closure panels and glass panes within the frame thus provided, each load-bearing column and horizontal beam includes a web portion having a stop rail or rabbet projecting outwardly from the web, with spaced parallel side walls or limbs projecting at right angles from the web and rabbet, with the stop rails of the columns and beams in a common plane. In assembling the individual wall sections, the panels and glass panes are placed in position against the stop rails of the columns and beams, then clamped permanently in position by retainer strips which are secured by screws to the webs, such that the panels are confined between the stop rails and retainer strips.

A further objective of the invention has been to provide a simple, convenient connector for joining the modular wall sections edgewisely to one another as the wall is assembled upon the footing, thereby to permit erection of the building wall rapidly and without special skills or tools.

According to this feature of the invention, each modular wall section includes mullion spacers in the form of threaded sleeves located within the column, with one end secured to the web and projecting toward the open face of the column. The wall sections are erected progressively, by placing the open column face of the successive wall section against the open column face of the section previously installed on the footing. Screws are then passed through the column web of the newly erected wall section and into threaded engagement with ends of the mullion spacers to provide a rigid splice between the adjacent wall sections.

A further objective has been top rovide a composite column structure utilizing two adjacent columns of the erected wall sections, which meet at the corner of the building, to provide a finished architectural appearance.

According to this concept, the columns of the erected wall sections reside at right angles to one another at the corner of the bulding, with the open faces of the columns exposed outwardly. In order to complete the corner column, a cover formed of sheet metal, which is right angular in cross section, provides a snap fit with the open faces of the adjoining right angular corner columns.

The various features of the invention will be more fully appparent to those skilled in the art from the following description taken in conjunction with the drawings.

DRAWINGS

FIGURE 1 is a perspective view of a building assembled with the modular wall sections of this invention.

FIGURE 2 is an enlarged fragmentary view taken from

FIGURE 1 showing several of the assembled erected prefabricated wall sections and including the doorframes.

FIGURE 3 is an anlarged sectional view taken along line 3—3 of FIGURE 2 illustrating a portion of one of the assembled wall sections.

FIGURE 4 is an exploded perspective view showing one of the horizontal beams or transoms of the composite wall section.

FIGURE 5 is an enlarged fragmentary perspective view, showing the assembly of the lower horizontal beam of the wall section, corresponding to the structure shown in FIGURE 3.

FIGURE 6 is an enlarged cross-sectional view similar to FIGURE 3, showing a modification in the construction of the weather sealing strips which are interposed about the marginal edges of the glass window pane.

FIGURE 7 is an exploded perspective view, indicated generally along line 7—7 of FIGURE 1, showing the components which make up the connection between the vertical load-supporting column or mullions and a panel-type wall which adjoins the window wall at one end of a building.

FIGURE 8 is an exploded perspective view, similar to FIGURE 7, showing one of the mullion spacers for making a splice between adjoining mullions or load-bearing columns during erection of adjoining wall sections.

FIGURE 9 is a sectional view taken along the line 9—9 of FIGURE 2, illustrating the assembled spacer connection between adjoining millions or columns of the wall sections.

FIGURE 10 is a fragmentary perspective view showing the corner post construction in the preferred version of the composite wall sections, utilizing a fixed corner clip.

FIGURE 11 is a sectional view along the line 11—11 of FIGURE 10, showing the procedure of inserting the closure element at one of the outside corners of the assembled wall units.

FIGURE 12 is an enlarged cross-sectional view, taken along line 12—12 of FIGURE 2, detailing the assembled load-supporting column and door jamb and including the reinforcement bracket between the door jamb and column.

FIGURE 13 is a cross-sectional view similar to FIGURE 12, showing a modified bracket arrangement, whereby the loadbearing column and door jamb are fitted together through the use of a snap-type connecting clip.

FIGURE 14 is an exploded perspective view illustrating the reinforcement bracket which is interposed between the door jamb and load-bearing column to assemble the two elements. This construction is used in conjunction with the mullion spacer construction shown in FIGURE 12 and in the snap-connecting structure shown in FIGURE 13.

FIGURE 15 is a cross-sectional view similar to FIGURE 13, showing the procedure in assembling the load-bearing column to the companion load-bearing column which includes the door jamb.

FIGURE 16 is a fragmentary perspective view similar to FIGURE 15, further illustrating hte snap-connecting clip between adjoining load-bearing columns.

FIGURE 17 is a perspective view similar to FIGURE 10, showing, as a modification, the snap-connecting clips which may be utilized at the corner posts of the building.

FIGURE 18 is a fragmentary perspective view illustrating the end configuration of the beam to provide the inset connection between one of the load-bearing columns and the connecting beam.

FIGURE 19 is a perspective view showing the several parts of one of the wall sections prior to assembly.

FIGURE 20 is a diagrammatic top plan view showing the procedure of installing an intermediate wall section in an erected wall.

FIGURE 21 is a diagrammatic sectional view taken along the line 21—21 of FIGURE 2, showing the connecting structure between the upper horizontal beam and roof structure of the building.

PREFABRICATED BUILDING GENERALLY

Referring to FIGURES 1 and 2, a building, indicated generally at 1, illustrates the modular load-bearing window wall sections 2 of the invention assembled to form the building walls in a typical structure which may be of the residential or commercial type. The building is erected upon a conventional masonry foundation (indicated later) and may include a basement; on the other hand, the building may be of slab construction, in which a concrete slab forms the floor of the bulding, with a footing supporting the walls, both forms of construction being conventional.

In the example illustrated, the erected window wall, indicated generally at 3, is formed in part of the wall sections 2 of the invention, and also includes one or more masonry sections such as is indicated at 4. In the present example, the bulding also includes a panel section 5 which may be of conventional wood or sheet metal construction (FIGURE 7). The sections 4 and 5 are installed in the assembled wall to enhance the appearance of the bulding. The modular wall sections 2, as explained later, have sufficient compressive strength to support the roof structure, which is indicated generally at 6 in FIGURE 1. It will be understood at this point that the lower ends of the wall sections 2 rest upon the foundation of the building and that the weight load of the roof structure 6 is imposed directly in compression upon the wall sections 2 and transmitted to the footing or foundation.

The wall sections 2, as explained later in detail, include provisions for doorway openings delineated by doorframes, indicated generally at 7 (FIGURES 1 and 2), consisting of jambs and headers, with in which the door or doors, indicated at 8, are hung in the conventional manner. In the example illustrated in FIGURE 1, double doorframes 7 are illustrated, each accommodating two doors 8, the construction of the doorframes being disclosed later.

Each wall section 2 is of composite construction comprising a pair of load-bearing columns 10—10 (FIGURE 2) spaced apart from one another, with horizontal beams or rails 11, 12, 13 and 14 spanning the spaced columns 10 (FIGURE 2). The lower beam 11 forms a sill which rests upon the footing and the upper beam 14 forms a head rail located beneath the roof structure. In the present example, the modular prefabricated wall sections 2 are furnished to the user in sizes having a width of four feet, and a selected height of eight, ten or twelve feet, depending on the type of building which is to be erected.

Each modular wall section 2 comprises prefabricated parts which may be assembled either in the field or in the plant. If the components are to be assembled in the field, then they may be packaged in individual groups, consisting of the necessary columns and beams, together with the closure panels, as explained later. If the wall sections 2 are asembled at the plant, then they are shipped as complete prefabricated units and are installed in side-by-side relationship and connected together, as shown in FIGURES 1 and 2.

As explained later, each modular wall section 2 includes suitable connecting devices, whereby they may conveniently be joined together collectively and clamped rigidly in side-by-side relationship. In erecting a building with the wall sections, the foundation or footing is first poured, together with the necessary floor slab. The masonry section 4, if the building is designed to include such section or sections, may then be laid up on the foundation or footing. The modular wall sections 2 are installed in sequence, starting from the masonry section 4 and working outwardly to the corners and around the building. The doorframe or doorframes 7 are installed at the proper locations within the wall section as the work progresses. If the building includes the panel sections

5, then the sections 5 preferably are joined to the edge of the wall sections 2, as explained later.

In the form of the invention shown in FIGURE 1, the doorframes 7—7 are of double width to accommodate the double doors 8—8. In this instance, the dor opening, which is delineated by the frame 7, has a total width of eight feet. On the other hand, single doorframes having a modular width of four feet, accommodating a single door, may be utilized (not shown).

As explained later, each modular wall section 2, in the form illustrated, includes three panels, indicated generally at 15, 16 and 17 (FIGURES 1 and 2). The panels may be formed of glass or of a solid material, such as composite sheet metal panels, or a combination of glass and sheet metal panels in any desired relationship. In the wall illustrated in FIGURE 2, the lower panel 15 consists of a composite sheet metal closure panel, the intermediate panel 16 comprises a glass window light and the upper panel 17 comprises a composite sheet metal closure panel. It will be understood at this point that the load-bearing vertical columns or mullions 10, in combination with the beams or transoms 11, 12, 13 and 14, absorb the stresses which may be imposed by the weight load of the roof 6 and other forces, such as wind pressure, which may act against the building walls, such stresses being isolated from the panels 15, 16 and 17.

MODULAR WALL SECTION

Described in detail, each wall section 2 comprises a pair of load-bearing columns (mullions) 10—10, with the horizontal beams (transoms) 11, 12, 13 and 14 spanning and interconnecting the columns (FIGURE 2). The erected wall, as noted earlier, is referred to in the industry as a window wall since the preferred embodiment of the invention does include the glass window panels 16. The interchangeable closure panels and glass panes, as noted, may be arranged in any desired combination, the thickness of the panels and panes (which include weather seals) being similar for interchangeability.

Each vertical, load-bearing column 10, in the preferred embodiment of the invention (FIGURE 7) is formed of sheet metal and is generally channel shaped in cross section, comprising a web 18 having limbs 20—20, each limb 20 including an inturned lip 21. The web 18 of the column includes an offset section forming a stop rail 22 which forms a stop for the closure panel and glass panes 15, 16 and 17, which, as noted above, are of equal thickness.

The beams 11, 12, 13 and 14 differ in cross section from the columns 10, but each beam 11–14 includes a corresponding stop rail 23 (FIGURE 7) such that the closure panels seat on all sides against the rails 22 and 23. As explained later, retaining beads, indicated generally at 24 (FIGURE 5), which are attached by screws, clamp the closure panels 15–17 against the rabbets 22 and 23 when the wall section 2 is asembled. The beams and columns also delineate openings for the door jambs 25 and header 26 (FIGURE 2).

WALL SECTION ASSEMBLY PROCEDURE

As best shown in FIGURE 19, the assembly of the wall section, whether in the field or at the manufacturing plant, is carried out by placing two of the load-bearing columns 10 upon the floor or upon sawhorses or trestles, the columns being cut to the required length, as noted earlier. The beams or transoms 11, 12, 13 and 14, which are cut to a length providing the modular overall width, are then located at the proper points along and between the spaced columns 10, which are drilled at the proper spacing in the column webs to provide the holes 27 to accommodate the end portions of the tie rods 28, which clamp the wall section rigidly in assembly (FIGURE 7).

As indicated in FIGURE 19, the ends 34 of the beams 11 are trimmed to reside in abutment with the webs 18 of the columns 10. In order to interfit the stop rails 22 of the columns 10, the opposite ends of each beam are inset as at 35 (FIGURES 18 and 19), such that the squared ends 34 of the beams 11 seat against the web 18 of the columns, with the insets 35 seated against the surface of the stop rails 22.

The tie rods 28 are then inserted through the horizontal beams 11–14 and through the holes 27 (FIGURES 7 and 10), the tie rods being slightly longer than the spacing of the webs 18—18, such that the threaded ends 37 project outwardly beyond the opposite webs. Nuts 38 are then applied to the projecting ends 37 to draw the opposite columns 10—10 into pressure engagement with the opposite ends of the beams to provide a rigid structure.

In order to aid in assembling the wall section 2, there is provided a locating bracket, indicated generally at 40 (FIGURE 7) which is formed of sheet metal having an end wall 41 and side flanges 42 configurated to interfit the end portion of the beams 11–14. The end wall 41 of each bracket 40 includes a hole 43 (FIGURE 7) for the reception of the end portion 37 of the tie rod 28, thereby to locate and support the tie rod with reference to the hollow beam for insertion into the holes 27 which are formed in the web 18 of the columns 10.

It will be noted in FIGURE 7 that the flanges 42—42 of the tie rod locating bracket 40 include right angular cut-out portions 45—45 which interfit the stop rail 22 of the column, such that the ends of the flanges 42—42 seat against the surface of the web 18 and rabbet 22 of column 10.

In order to reinforce the frame of wall section 2, reinforcing brackets 46 are inserted within each column 10 to receive the threaded end portion 37 of the tie rod (FIGURE 7). The reinforcing bracket 46 is generally channel shaped as at 47 and includes a flange 48 projecting upwardly from one of the limbs of the channel. The reinforcement bracket 46 further includes a horizontal flange 50 (FIGURE 7) projecting rearwardly from the channel portion of the bracket.

The tie rod reinforcement bracket 46 is inserted within the column 10 such that the channel-shaped portion 47 seats against the web 18, with the edge of flange 50 seated against the surface of stop rail 22.

The web of the reinforcement bracket 46 includes an aperture 51 (FIGURE 7) to receive the threaded end portion 37 of the tie rod, such that the clamping nut 38 bears against the web of the channel-shaped reinforcing bracket 47 when the columns 10 and beams 11 are assembled and clamped to form the rigid frame of wall section 2.

The upstanding flange 48 of the tie rod reinforcement bracket 46 includes a hole 52 (FIGURE 7). The purpose of the reinforcement bracket 46 is to provide means for anchoring the end of the tie rod. The purpose of hole 52 is to accommodate a screw for anchoring the end of the wall section to the conventional panel section 5. In the form of the invention illustrated in FIGURE 7, the end wall section 2 is secured to the panel section 5 by screws 53 passing through holes 54 formed in the web of the panel section 5. The screw 53 is threaded into the hole 52 of flange 48 of the tie rod reinforcing bracket 46, bearing in mind that the bracket 46 is clamped rigidly in place by the nut 38 of tie rod 28.

After the columns and beams are assembled to provide the framework of the wall section, the glass pane 16 and closure panels 15 and 17, previously described, are placed in position within the frames (in the present example, three) delineated by the columns 10 and beams 11–14 as indicated by the broken lines in FIGURE 19. As noted earlier, the composite sheet metal closure panels 15 and 17 and glass pane 16 (with its sealing strip) are of the same thickness so that they may be installed within the wall section if any desired combination.

Upon being inserted within the several frames delineated by the columns 10 and cross beams 11–14 (FIG-

URE 19), the marginal edges of the closure panels **15** and **17** and glass window pane **16** rest against the stop rails **22** of the columns **10** and the matching stop rails **23** of the cross beams **11–14**. After the closure panels and glass window pane are thus located, they are clamped in place within the wall section **2** by means of retaining beads **24** (FIGURES 3, 4, 5 and 6).

From the foregoing, it will be understood that the tie rod reinforcement bracket **46** has the double purpose of providing a reinforcement member whereby the nuts **38** of the tie rod **28** may be tightened securely so as to draw the columns **10** under pressure against the ends of the beams **11–14** through which the tie rods pass, thereby to provide a rigid framework, with the tie rods in tension and the cross beams **11** under compression. Secondarily, the tie rod reinforcement brackets **46** also provide means for connecting the end self-contained modular wall section **2** rigidly to the adjoining conventional panel section **5**.

As noted earlier, each wall section **2** is assembled either at the manufacturing plant or in the field, in either event, the individual wall sections **2** comprise self-contained units which are joined together in a simple manner by mullion spacers inserted between the adjoining columns to provide a clamping effect, as explained later.

As best shown in FIGURES 3–5, each beam (transom) **11–14** generally is of composite design, each having a body portion **59** which is generally U-shaped in cross section, the body portion **59** having a web **55**, a pair of limbs **56—56**, with lips **57—57** projecting from the ends of the limbs **56**. A cover section, indicated generally at **58**, also formed of sheet metal, includes a web portion **60**, limbs **61—61**, with inturned lips **62—62** overlying the lips **57** of body portion **59**.

Each glass pane **16** includes a U-shaped gasket **63** formed of a resilient material engaged about its marginal edges to provide a weather seal (FIGURES 3, 4 and 5). The width of the glass pane and its weather seal is equal to the thickness of the composite sheet metal closure panels **15** and **17**. It will be noted in FIGURE 3 that each closure panel comprises a pair of covers **64—64** formed of sheet metal, with a sound deadening filler or core **65** formed of fibrous or plastic material to provide a stiffening and sound deadening effect.

After the glass panes and panels are placed against the stop rails, the retaining beads **24** are installed to clamp the panels against the rabbets. As shown in FIGURES 3–5, each retainer bead is formed of sheet metal and is generally U-shaped in cross section. The retainer beads **24** are secured in place by screws **67** passing through the web of the bead and threaded into spaced holes **66** which are tapped in the webs **18** of the columns and in the limbs and webs **55** and **56** of the beams.

In the modified weather sealing structure shown in FIGURE 6, the weather sealing strip or gasket comprises two separate strips **68** formed of a suitable plastic material which has serrated outer surfaces **70** and a head portion **71**. These strips are forced into position, as indicated in broken lines, (FIGURE 6) in the space existing between opposed surfaces of the glass pane **16** and the surface of the rabbet and retaining bead.

MULLION SPACERS

As noted earlier, the self-contained wall sections **2** are connected together by means of mullion spacers **69** which span the webs **18** of adjoining columns **10** of the wall sections **2** to form a splice. Each spacer **69** comprises a threaded cylindrical bar, the opposite ends of which are tapped as at **72** to receive the clamping screws **73—73**. As shown in FIGURE 8, the webs **18** of the columns **10** include apertures **74** to receive the shanks of the screws **73**.

MODIFIED SEALING STRIPS

In the modified arrangement shown in FIGURES 8 and 9, the inturned lips **21—21** of the adjoining columns **10—10** are provided with sealing strips **75** which seal off the adjoining edges of the wall sections **2** against water and air leakage. The sealing strips **75** are formed of a pliable or resilient material, such as one of the plastics, and are held in compression between the opposed lips by the clamping action exerted by the screws **73** of the mullion spacers **69** (FIGURES 8 and 9). It will be understood, at this point that smilar sealing strips **75** may be applied to the opposed lips **21** in the embodiment of the invention shown in FIGURE 7.

MODIFIED CONNECTOR CLIP

A modified snap-type connector, indicated generally at **76**, is illustrated in FIGURES 13–17. In this construction, the mullions or columns **10** are joined together without the use of the mullion spacers **69**; instead, the snap connector **76** provides means by which the adjoining columns **10** are joined together by a camming and snap action.

Described in detail (FIGURES 13–16), the snap connector **76** is formed of sheet metal and is generally U-shaped in cross section comprising a web **77** and upper and lower limbs **78** and **80**. When utilized in connecting two adjoining columns **10—10** (FIGURE 16), several connectors **76** are attached to one of the columns **10** by means of screws (not shown) passing through the web **77** of the connector **76** and through the web **18** of one of the columns **10**.

In order to join the mating columns **10—10**, the upper limb **78** of the snap connector **76** is notched as at **81** and **82** to receive the inturned lips **21—21** of the column **10** which is to be snapped into mating engagement with its adjoining column **10**. The width of the notches **81** and **82** is approximately twice the thickness of the sheet metal lips **21—21** which interfit the notches as shown in FIGURE 15, such that the mating lips **21—21** of the adjacent sections fit readily into the notches **81** and **82**.

As noted earlier, the modular wall sections **2** are erected successively. In assembling the wall sections **2**, using the snap connectors **76**, the connectors **76** are attached along one edge of each wall section at spaced points along the length of the vertical column, the arrangement being such that the connectors **76** reside along the exposed edge of each section, as the sections are erected. Thus, as shown in FIGURES 13–16, the connectors **76** are located along the right-hand edge of each wall section **2**.

After a given wall section **2** is installed, the next wall section is attached by placing one of its inturned lips **21** (FIGURES 15 and 16) into the notch **82** along one side of the snap connector **76** and in abutment with the inturned lip **21** of the mating column **10**. The mating column **10** thereafter is pivoted as shown by the arrow **83** (FIGURE 15) causing the opposite lip **21** to cam against the curved edge portion **84**, leading to the second notch **81**.

As the lip **21** cams and follows the curved edge **84** of the connector, the limb **20** on that side of column **10** is sprung outwardly, as indicated by the arrow **85** (FIGURE 15). As the lip **21** reaches the notch **81**, the lip snaps into the notch (FIGURE 13), thereby connecting the second column of the next wall section **2** to the wall section **2** which previously has been installed upon the footing. It will be understood that identical wall sections **2**, each having snap connectors **76** installed along the column at one edge may be installed successively in a rapid convenient manner, the wall sections being installed by placing one lip **21** of this column in the notch **81** or **82** (the notch **82** being shown engaged in FIGURES 15 and 16). Thereafter, the wall section is swung in an arc and into alignment with the wall. By virtue of this construction, the wall section, as it is installed, acts as a lever to provide the camming action without undue effort on the part of the installer.

COMPOSITE CORNER POST

As best shown in FIGURES 10 and 11, the corners of the building are delineated by the composite corner posts, indicated generally at **86**. It is to be noted at this point that each composite corner post is constructed from columns **10** of identical cross-sectional configuration, as described earlier, the two columns being disposed at right angles to one another at the meeting corners of the erected wall.

During the erection of the building, as noted earlier, the assembled self-contained wall sections **2** are installed upon the footing successively and joined in edge-to-edge relationship by the mullion spacers **69** (FIGURE 8). The composite corner posts **86**, shown in FIGURES 10 and 11, comprise the two columns **10** of the adjacent corner wall sections **2** located in right angular abutting relationship. As seen in FIGURE 10, the corners of the abutting lips **21—21** at the inside of the building are held in assembly by a series of right angular corner clips **87** located in spaced relationship along the length of the mating corner columns **10**.

The corner clips **87** are attached by screws **88—88** to respective locating brackets, indicated at **90** (FIGURE 10). The brackets **90** may be similar to the U-shaped brackets **104**, as described later. The screws **88**, in this example, pass through the web **18** of each column **10**, the arrangement being such that the screws **88** pull the corner clip in clamping engagement with the opposed lips **21—21** of the columns. The screws in the present example may be tightened with a screw driver, the outer portion of the composite corner posts **86** being open at this stage in the erection procedure.

After the several corner clips **87** have been secured in place along the composite corner posts **86**, a right angular cover **89** is snapped in place to cover the open portion of the composite corner post **86** so as to protect the structure and provide a neat architectural appearance. The cover **89** is formed of sheet metal and essentially comprises the two limbs **91—91**, each limb **91** at its free edge portion including a right angular lip **92**.

In order to provide the snap connection, the outer end portions of each corner clip **87** include an inset portion **93—93** which resides in spaced relationship to the lips **21** of the composite corner posts **86**. The outer end portion of each inset **93** is bent inwardly to form a curve **94**, with an angular flange extending inwardly from the curved portion **94** (FIGURE 11).

After the corner post is assembled with the mating columns **10—10** secured together by the angular corner clips **87**, the cover **89** is snapped in place to complete the assembly (FIGURE 11). For this purpose, one lip **92** of cover **89** is inserted into the space delineated by the lip **21** of column **10** and the inset **93** of the corner clip **87**. Thereafter, the corner cover is forced in the direction indicated by the arrow **95** (FIGURE 11) over the curve **94** so as to cam the free edge of the cover. The retaining lip **92** then snaps into place behind the inset area **93** of the corner clips to complete the assembly of the corner posts **86**.

COMPOSITE CORNER POST (MODIFIED VERSION)

In the modified corner post construction, indicated generally at **96** in FIGURE 17, the structure is identical to the corner post **86** above described, except that snap connectors, previously indicated at **76**, are utilized in place of the right angular corner clip **87**, previously described with the corner post construction shown in FIGURE 10. In the modified version, a number of the snap connectors **76** are secured to the outer end portions of the self-contained wall sections **2** by means of screws (not shown) which pass through the web of the snap connector and web **18** of the column **10**. The wall sections **2** are assembled and clamped together by means of the tie rods **28**, as described earlier.

After the wall sections **2** are assembled, with the columns **10—10** meeting at the corner of the building, a right angular closure strip **97** (FIGURE 17) formed of sheet metal is placed in position against the inturned lips **21—21** of the columns **10** at the inside corner of the building. The closure strip **97** is engaged in the notches **81** and **82** of the snap connector **76**. The notches **81** and **82** at the outer ends of the snap connectors **76** are then utilized to lock the right angular cover **89** in place. The cover **89** is similar to that disclosed in FIGURE 10, in this case, the retainer lips **92** being engaged within the notches **81** and **82** of the snap connectors **76**.

DOORFRAME

As noted earlier, the doorframe **7** (FIGURES 1 and 2) may be installed to accommodate either a single door **8** or the double doors **8—8**. In either event, the doorframe or frames are installed in a simple convenient manner at any desired location along the front or side walls of the building.

Described in detail (FIGURES 12–15), each doorframe **7** may be installed at the desired location along the wall simply by omitting the lower beams or transoms **11** and **12**, and the closure panel **15** and glass pane **16** in that area to provide the door opening or openings. In order to accommodate the door **8**, a door jamb **98** is secured to the column **10** along one side of the door opening. The door jamb is formed of sheet metal, generally channel-shaped in cross section, each member comprising a web portion **100**, with a stop portion **101** (against which the door **8** seats) projecting inwardly from web **100**. The web **100** and stop **101** each includes spaced limbs **102—102**, the outer edge of each limb including an inturned lip **103—103** seated against the web **18** and rabbet **22** of the column **10**.

The jamb member **98** is secured to its column **10** and reinforced by a series of spacer brackets **104** (FIGURES 12–15) each bracket being generally U-shaped in cross section providing a web **105** having spaced limbs **106—106** (FIGURE 14). The limbs **106** are notched to accommodate the inturned lip **103** (FIGURE 15) of the jamb member **98**. Each spacer bracket **104** is secured in place by a screw **107** passing through the web **100** of the jamb member **98** and through the web **18** of the column **10**.

The upper and swinging marginal edges of the door seat against the stop rail **23** of the beam **13** and the stop rail **22** of column **10**, the stop rails being in the same plane as the stop **101** of jamb **98** (FIGURES 12 and 13). The door is hung with respect to the jamb reinforcement strip **98** in the usual way, by means of hinges **108** (FIGURE 12) having leaves secured to the edge of the door **8** and to the web **100** of the jamb reinforcing strip **98**. The free edge of the door is provided with a handle **110** (FIGURE 2) and with the usual lock (not shown).

In the modified structure utilizing the snap connector **76** (FIGURES 13–15) the columns **10**, the beam **13**, which act as door jambs and headers, are constructed in the same manner as described with reference to FIGURE 12. However, in the modified arrangement, the mullion spacers **69** (shown in FIGURE 12) are omitted and instead, the snap connectors **76** (FIGURE 13) are installed in spaced locations within the vertical columns **10** (jambs) and beam **13** (header) to provide the connection.

SILL AND ROOF CONSTRUCTION

As noted earlier, the self-contained assembled wall sections **2** support the roof structure **6** (FIGURES 1, 2, 3 and 21). The lower beam **11** acts as a sill and is generally channel-shaped, comprising a web **112**, having a

stop rail **113**, with limbs **114—114** projecting downwardly. The lower ends of the limbs include inturned lips **115—115** which seat against a Z-shaped foundation rail **127** resting upon the footing or foundation **116**.

A tie rod **28** (FIGURE 3) extends through the beam or sill **11** and passes through locating brackets **40**, as described earlier with reference to FIGURE 7. The columns **10—10** are clamped against the opposite ends of beam **11** by means of nuts **38** (FIGURE 7) set upon the end portions **37** of the tie rods.

As shown in FIGURE 3, the Z-shaped foundation rail **127** includes a drip flange **128** depending downwardly alongside the foundation **116**. The inner edge of the foundation rail includes an upstanding flange **130** seated against the internal surface or limb **114** of the sill **11**.

In order to provide a finished architectural appearance, there is provided a base strip **131** which resides along the lower inside portion of the window wall, similar to the conventional base strip which is ordinarily formed of wood. The base strip **131** preferably extends for the full length of the assembled indow wall to provide a neat appearance. The base strip **131** is formed of sheet metal and is arranged to be snapped in place after the window wall sections have been erected.

In order to provide the snap-on connection, there is provided a base mounting rail **132** (FIGURE 3) which extends across the assembled window wall. The base mounting rail **132** is secured to the sill **11** by means of self-tapping screws **133**.

For mounting the base strip **131**, the mounting rail **132** is generally U-shaped in cross section providing an upper flange **134** spaced from the sill **11**, as indicated at **135**. The lower flange of the retaining rail **136** is generally V-shaped in cross section.

In order to mount the base strip **131**, its upper edge is provided with a downwardly depending lip **137**. This lip interfits the clearance, previously indicated at **135**, to permit insertion of the lip **137**. The lower edge of base strip **131** includes an inturned flange **138** having an upwardly projecting lip **140** (FIGURE 3). In applying the base strip **131**, with its upper lip **137** inserted into the space **135**, the lower edge of the base strip **131** is forced against the lower, V-shaped portion **136** of the base mounting rail **132**, causing the lower flange **138** to be cammed outwardly then inwardly toward the sill **11**, thus completing the assembly.

As shown in FIGURE 21, the beam **14**, which supports the roof structure **6**, is generally similar in cross section to the lower beam or sill **11** but is reversed in position. The roof structure **6** does not form a part of the invention; therefore, this structure has not been illustrated in detail. The roof structure preferably comprises conventional I-beams **117** having a lower flange **118** resting upon the top beams **14**. The rool structure may include a ceiling panel **120** and an outer wall panel **121**, the ceiling panel **120** being secured to the lower surface of the flanges **118** of the I-beams. A Z-shaped strip **122** rests upon the inturned lips **115** of the upper beam **14** and embraces the edge portion of the wall **121** and ceiling **120**, and is secured by the screws **123** and **124** to the wall panel **121** and to the limb **20** of the beam **14**. Clamping plates **125** may be placed within the beam **14** as spaced intervals and drawn into clamping engagement with the lips **115** of beam **14** by screws **126**.

REPLACEMENT OF WALL SECTIONS

In the event that one of the wall sections **2** of the erected building wall be damaged and require replacement, the damaged wall section can be replaced without disturbing the assembled window wall, the procedure being shown diagrammatically in FIGURE 20. In the diagram, the damaged wall section **2** is indicated at **127** and is replaced by removing the retaining beads **24** to expose the screws of the mullion spacers **69**. The screws are then loosened and removed, as indicated, allowing the sections to be swung outwardly in the fashion of a pair of swinging doors, permitting the damaged section **127** to be removed. The damaged section is then replaced and the wall sections, including the replacement section, are hinged back into alignment, thus forcing the wall sections into engagement in toggle fashion. Thereafter, the screws of the mullion spacers **69** are threaded in and tightened to complete the operation.

Having described my invention, I claim:

1. A self-contained prefabricated building wall section comprising:

a pair of vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section and having apertures formed therein;

a plurality of horizontal beams formed of sheet metal and extending transversely between the said spaced vertical columns and being spaced vertically one above the other;

said beams being generally hollow in cross section;

tie rod locating brackets seated within the opposite end portions of said horizontal beams, each of said locating brackets having an aperture aligned with the apertures of the columns;

reinforcing brackets located within the interior of the generally hollow vertical columns and seated against the internal surface of the webs of the columns;

said reinforcing brackets having apertures aligned with the apertures of the columns and locating brackets;

tie rods having opposite end portions passing through the aligned apertures of said columns, locating brackets, and reinforcing brackets;

clamping means on the end portions of said tie rods engaging the reinforcing brackets of the columns and drawing the columns into pressure engagement against the opposite ends of said beams, with said tie rods in tension and with the beams under compression between the columns;

each of said reinforcing brackets including a flange which is spaced from the web of the column in which it is located;

the said flange of each reinforcing bracket having a hole formed therein for receiving a screw securing the column and beam assembly to the column of an adjoining column and beam assembly;

said columns and beams delineating at least one opening;

and a closure panel seated within the opening delineated by said vertical columns and transverse beams.

2. A composite building wall constructed from self-contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of said beams being formed of sheet metal and being generally hollow in cross section;

reinforcing brackets located within the interior of the hollow vertical column and seated against the interior web portions thereof;

said reinforcing brackets having apertures aligned with the apertures of the columns;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of

said vertical columns and the apertures of the reinforcing brackets;

nuts threaded upon the end portions of the tie rods engaging the reinforcing brackets of the columns and clamping the reinforcing brackets and columns in pressure engagement against the opposite ends of said horizontal beams, with the rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

and a closure panel seated within the opening delineated by said vertical columns and transverse beams;

and mullion spacers extending between adjacent columns and clamping the adjoining columns to one another to form the composite building wall.

3. A composite building wall constructed from self-contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of said beams being formed of sheet metal and being generally hollow in cross section;

reinforcing brackets located within the interior of the hollow vertical columns and seated against the inner surface of the web portions thereof;

said reinforcing brackets having apertures aligned with the apertures of the columns;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of said vertical columns and through the apertures of the reinforcing brackets;

clamping means on the end portions of the tie rods, said clamping means engaging the reinforcing brackets of the columns and clamping the reinforcing brackets and columns in pressure engagement against the opposite ends of said horizontal beams, with the rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

a closure panel seated within the opening delineated by said vertical columns and transverse beams;

each of said reinforcing brackets having a flange which includes a hole;

and a self-tapping screw passing through the web portion of at least one vertical column of the composite building wall and in threaded engagement with the hole of the flange of the reinforcing bracket and securing the column to an adjoining wall structure.

4. A composite building wall constructed from self-contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of said beams being formed of sheet metal and being generally hollow in cross section;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of said vertical columns;

clamping means on the end portions of said tie rods within the column engaging said web portions and drawing the said vertical columns into pressure engagement against the opposite ends of said horizontal beams, with said tie rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

a closure panel seated within the opening delineated by said vertical columns and transverse beams;

a plurality of mullion spacers extending between the webs of the columns of adjoining wall sections;

each of said mullion spacers including threaded holes in opposite end portions thereof;

and screws passing through the webs of the adjoining columns and into threaded engagement with the threaded holes in the opposite ends of the mullion spacers and drawing said columns into clamping engagement with one another;

said self-contained wall sections thereby being erected in side-by-side relationship, with the columns of the adjoining wall sections in clamping engagement with one another.

5. A composite building wall constructed from self-contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of scaid beams being formed of sheet metal and being generally hollow in cross section;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of said vertical columns;

clamping means on the end portions of said tie rods within the columns engaging said web portions and drawing the said vertical columns into pressure engagement against the opposite ends of said horizontal beams, with said tie rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

a closure panel seated within the opening delineated by said vertical columns and transverse beams;

a plurality of mullion spacers extending between the webs of the columns of adjoining wall sections;

each of said mullion spacers including threaded holes at opposite end portions thereof;

screws passing through the webs of adjoining columns and into threaded engagement with the threaded holes in the opposite ends of the mullion spacers and drawing said columns into clamping engagement with one another;

said adjoining columns having generally parallel inturned lips facing one another;

sealing strips interposed between the inturned lips of the adjoining columns and drawn into sealing engagement with one another by the screws of the mullion spacers;

said self-contained wall sections thereby being erected in side-by-side relationship, with the columns of the adjoining wall sections clamped in sealing engagement with one another.

6. A composite building wall constructed from self-

contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of said beams being formed of sheet metal and being generally hollow in cross section;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of said vertical columns;

clamping means on said tie rods and within the columns engaging said web portions and drawing said vertical columns into pressure engagement against the opposite ends of said horizontal beams, with said tie rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

a closure panel seated within the opening delineated by said vertical columns and transverse beams;

said self-contained wall sections being erected in side-by-side relationship;

each of said hollow load-bearing columns including generally parallel inturned lips projecting inwardly toward one another;

a plurality of snap connectors secured within the columns at spaced points along the length thereof;

each of said snap connectors including a portion projecting outwardly beyond the lips of a column;

the extended portions of each of said snap connectors including notches formed along the opposite side edges thereof;

the adjoining columns being connected with one another by engagement of the opposed lips of the columns by the opposed notches of the snap connectors;

said self-contained wall sections thereby being erected in side-by-side relationship, with the columns of adjoining wall sections in contact with one another.

7. A self-contained prefabricated building wall section comprising:

a pair of vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

a plurality of horizontal beams formed of sheet metal and extending transversely between the said spaced vertical columns and being spaced vertically one above the other;

said beams being generally hollow in cross section;

tie rod locating means seated within the opposite end portions of said horizontal beams;

each of said tie rod locating means having an opening formed therein;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the openings of said tie rod locating means and through the web portions of the vertical columns;

reinforcing means located within the interior of the generally hollow vertical columns and seated against the inside surface of the web portions thereof;

said reinforcing means having openings formed therein, with the end portions of the tie rods passing through said openings;

clamping means on the end portions of said tie rods within the columns and engaging the said reinforcing means;

said clamping means drawing the said reinforcing means and vertical columns into pressure engagement against the opposite ends of said beams, with said tie rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

and a closure panel seated within the opening delineated by said vertical columns and transverse beams.

8. A composite building wall constructed from self-contained prefabricated wall sections, each of said wall sections comprising:

a pair of opposed vertical load-bearing columns formed of sheet metal and spaced laterally apart from one another;

said load-bearing columns being generally hollow in cross section and having web portions facing one another at opposite sides of the wall section;

said web portions including apertures spaced apart from one another;

a plurality of horizontal beams extending transversely between the said spaced vertical columns;

each of said beams being formed of sheet metal and being generally hollow in cross section;

a tie rod extending longitudinally through each of said horizontal beams and having opposite end portions passing through the apertures of the web portions of said vertical columns;

clamping means on said tie rods and within the columns engaging said web portions and drawing said vertical columns into pressure engagement against the opposite ends of said horizontal beams with said tie rods in tension and with the beams under compression between the columns;

said columns and beams delineating at least one opening;

a closure panel seated within the opening delineated by said vertical columns and transverse beams;

said self-contained wall sections being erected in right angular relationship at the corner of the building, with the inner corners of the columns in contact at the inside of the building;

each of said hollow load-bearing columns including an open face facing outwardly at right angles at the corner of the building;

said open faces having generally parallel inturned lips projecting inwardly at right angles to one another;

a plurality of one-piece snap connectors secured within the columns at spaced points along the length thereof at the corner of the building;

each of said snap connectors including a portion projecting outwardly beyond the lips of the column at the right angular open faces of the columns;

the projecting portion of each of said snap connectors including camming portions formed along the opposite end portions thereof;

and a right angular cover plate having inturned lips formed at the outer edges of the cover plate and disposed at right angles and parallel with the inturned lips of the columns;

said lips of the columns and cover plate being in face-to-face relationship and connected together by snap engagement with the opposed camming portions of the snap connectors.

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